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SPECIFICATION

Clamping Means

The present invention pertains to a clamping means for components, especially body parts, with the features in the preamble of the principal claim.

It is known and common in the practice of manufacturing vehicle body shells to clamp the body parts by means of clamping frames in so-called framing stations or even in downstream welding stations. These clamping frames comprise a massive frame, on which a plurality of individual clamping units are arranged at the needed locations. A plurality of components can be clamped together with these individual clamping units, and a component flange that is needed for the welded connection and another component clamping contour are formed now. Such a clamping frame in conjunction with a conventional feed device is known, e.g., from DE 38 28 267 A1. Furthermore, it is known from EP 0 760 770 B1 that such clamping frames can also be handled by means of robots and can be fed to the vehicle body.

Stationary clamping means, which comprise a plurality of individual clamping units, into which the components are inserted, are used in the construction of jigs and fixtures. Such a clamping means is known, for example, from DE 201 03 412 U1.

The use of individual clamping units in the prior-art clamping means has various drawbacks. Due to their size, the individual clamping units can be arranged at greater distances only, which leads to

problems for some clamping tasks. On the other hand, deformations of the components may occur because the individual clamping units are usually closed offset in time and due to the punctiform clamping action. Finally, the clamping units must be opened and then closed one after another during seam welding by means of a laser beam in order to make possible the circulation of the laser beam without obstacles. This may likewise lead locally to clamping problems because of the great distances between the clamping units, especially when the flange of the component is opened and undesired or excessively large gaps are formed as a result between the components. Special problems arise during the clamping of component flanges at openings in the body, e.g., door or window openings. The individual clamping units often fail to satisfactorily accomplish the clamping tasks for the above-mentioned reasons. In addition, they hinder access for machining devices, e.g., welding robots, etc., due to their large space requirement. On the whole, the clamping means equipped with individual clamping units inherently have the drawbacks of having a large space requirement and a heavy weight, requiring great efforts for assembly and adjustment and a correspondingly high price.

The object of the present invention is to show an improved clamping technique.

This object is accomplished by the present invention with the features in the principal claim.

The clamping means being claimed has the advantage that it leads to better clamping results, has a smaller space requirement and can be designed, in particular, as a very flat clamping means. Moreover, the clamping means has considerably more free space for machining devices. Special advantages arise when entire cutouts or contours are to be clamped all at once on components, which happens, e.g., in case of body openings, connection sites between body parts, e.g., the side

wall and the roof part or the like.

The clamping devices being claimed make it possible to create any desired geometry with a minimum space requirement with the clamping segments. Due to the flat design, it is possible now to keep the clamping units closed during the machining of the flange, e.g., during laser seam welding and to create and maintain defined clamping and process conditions as a result. Furthermore, it is possible to actuate the clamping units together in a controllable sequence and to feed them preferably simultaneously in the process and to bring them into a clamped connection. As a result, exactly defined clamping conditions can be created, and undesired deformations of the components are avoided.

Special advantages arise when internal flanges at openings of components, especially door or window openings of body components, are to be clamped. The component flange can be clamped circumferentially with a simple clamping device, it can be fed to the component opening thanks to the preferred feed and clamping kinematics of the clamping device with retracted movable clamping units. The retracted clamping units can now be moved past the flange of the component and then fed to the rear side of the flange and brought into the clamped position. As an alternative, clamping of one or more component flanges located on the outside is possible.

The clamping devices can be fed in any desired manner and they can also be fixed in their clamped position. Due to corresponding suitable supports, it is possible now to create both an external network reference and a component reference. Component tolerances that may be present are absorbed in the external network reference and deformed components are forced, if necessary, into the correct desired position during clamping. However, the supporting takes place in relation to external positioning means. When a component reference is formed, the clamping device is

oriented according to the existing geometry of the components, and the supporting is in relation to suitable reference points on the components. Component tolerances can be tolerated to a greater extent in this case.

The clamping devices can be arranged on conventional clamping frames instead of the individual clamping units and moved by these clamping frames relative to the vehicle body. A modular clamping frame design is possible now by means of standardized feed modules. As an alternative, the clamping devices may also be fed in any other desired manner, e.g., by means of conveying robots. For example, lifting devices or conveyors with a holder for a plurality of clamping devices, which said holder has feed and movement axes of its own, are suitable for internal or external feed. The clamping devices are suitable, furthermore, for manual feed, which is possible, e.g., by means of a movable suspension on a balancer. In case of manual feed or feed by means of conveying robots, a stationary guide for docking or fixed points may be present at the component for the exact positioning of the clamping devices. The clamping devices may, furthermore, be self-supporting in the clamped position and supported at the component, which is possible, e.g., in case of the welding of previously tacked components and in case of sufficient stability of the clamping contour of other support points on the component.

The clamping devices have an adjusting device, with which the movable clamping units are fed in the desired manner and brought to the fixed clamping units in the clamped connection. A very great variety of possible design embodiments are available for the adjusting device. In the preferred embodiment with cam shafts, it is possible to move all movable clamping units movably and in a defined manner by means of a single drive motor, in which case movement along two axes is possible during feeding and clamping. As an alternative, a manual clamping drive with a ratchet or

the like may be used. In addition, the feed device, especially a robot, may be used as a clamping drive.

The component flanges may be clamped in any desired clamped position. A deliberate gap formation is also possible now, as it is useful, for example, for welding coated sheets for releasing gases from the coating. The clamping device may, furthermore, also be used to deform the component flanges, in addition to clamping them, in which case, e.g., beads are embossed to form local gaps between the component flanges. This embossing operation may be carried out separately prior to the clamping and optionally also on the individual component.

The present invention is schematically represented in the drawings as an example. Specifically,

Figure 1 shows a clamping means with two clamping devices at a vehicle body,

Figure 2 shows a cut-away and enlarged cross section through a clamping device in the corner area,

Figure 3 shows a tilted side view of the arrangement according to Figure 2 along arrow III,

Figure 4 shows a top view of the arrangement according to Figure 2 along arrow IV,

Figure 5 shows a cut-away bottom view of the clamping device along arrow IV

in Figure 3,

Figures 6 through 9	show a variant of the clamping units in different movement positions,
Figure 10	shows a perspective view of a cam shaft with feed and clamping cam along with sliding blocks,
Figure 11	shows a front view of a machining station with a clamping means with a plurality of conveying robots and clamping devices,
Figure 12	shows a variant of the machining station according to Figure 11 with another feed device for internal feed from the top,
Figure 13	shows a side view of a vehicle side wall with two clamping devices fed from the inside in the door cutouts,
Figures 14 and 15	show a side view and front view of a variant of Figure 12 with a front-side internal feed of clamping devices,
Figure 16	shows a modular design of a feed device for clamping devices,
Figure 17	shows a variant of the clamping device with external feed,
Figure 18	shows a clamping situation with component flanges lying one on top

of another, and

Figures 19, 20 show a variant of the clamping situation with a gap between the component flanges.

The present invention pertains to a clamping means (1), which comprises at least one or more clamping devices (2, 3), which will hereinafter be described in detail. Furthermore, one or more feed devices, which are designed as a clamping frame (4) in one variant and as a robot (5) in the other variant in the exemplary embodiments being shown, belong to the clamping means (1). The present invention pertains, in addition, to a machining station (6), especially a framing station or geo station, with such a clamping means (1) and additional components, not shown, e.g., machining devices, especially welding robots, tool magazines, component conveyors and the like.

The clamping means (1) is used to clamp components (8, 9). These are preferably body parts. However, the components (8, 9) may otherwise be any other desired workpieces. The components (8, 9) clamped together may be machined or treated in any desired manner. They are usually joined together or connected to one another, which is carried out by means of a suitable machining tool (7), e.g., the laser welding head shown schematically in Figure 1. The components (8, 9) to be connected, which are components of a vehicle side wall in the exemplary embodiment according to Figure 1, have bent edges, which lie one on top of another and form at least one flange of the component. The components (8, 9) are clamped by the clamping means (1) on this component flange (11), which also forms the clamping contour of the component at the same time, in their connected position. In the exemplary embodiment according to Figure 1, the components (8, 9) have two component openings (10), which represent the front and rear door openings of the side

wall. An internal component flange (11), which extends circumferentially over the entire contour of the opening, is present at these component openings (10).

These circumferential component flanges (11) are clamped with the clamping devices (2) described in greater detail below over a varying part of their length. In the variant according to Figure 1, the clamped length is the entire component flange (11) extending circumferentially over the component opening. In the variant according to Figure 17, the clamped length is shorter, and, e.g., only two component flanges (11) on both sides are clamped at the B pillar (53). The clamping devices (2) are positioned now at and at least partially in the component openings (10). In the internal area or on the side, the clamping devices (2, 3) leave open a free space (16), through which machining devices, e.g., multiaxial welding robots, can pass and machine the rear side of the body side wall, which is invisible in the drawings in Figures 1 and 17, with their machining tools.

The clamping devices (2) have a network reference in the embodiment shown in Figure 1. They are now fastened via a plurality of suitable supports (17), e.g., mounting flanges, on struts of a surrounding clamping frame (4). The clamping frame (4) is brought in the machining station into a predetermined position in space in a suitable manner and held in that position. The clamping frame (4) can be positioned for this purpose stationarily at a frame or even at a pallet-like support of the components (8, 9) and pegged out. The clamping frame (4) forms a feed device, with which both clamping devices (2) can be fed to the components (8, 9). The feed motion may also be kinematically reversed. Due to the clamping function of the clamping devices (2), the components (8, 9) are clamped in a position predetermined in the absolute system of space coordinates and somewhat defined in the process, if necessary, in case of deviations in dimensions and shape.

Figure 11 illustrates a machining station (6), at which the clamping devices (2) are fed by means of robots (5) to the side parts of the body (8, 9), which is already loosely pretacked. The robots (5) are two articulated arm robots arranged in a floor-bound manner on both sides of the transfer line and the component conveyor with six or more axes. The clamping devices (2) are detachably and replaceably connected with the robot hands via suitable devices and optionally also via change-over couplings.

In addition, another clamping device (3), which clamps parts of the roof construction and optionally parts of the side walls of the body, is present in the roof area of the body (8, 9) in the variant shown in Figure 11. The clamping device (3) may likewise be fed by means of a robot (5), e.g., a portal robot. The three clamping devices (2, 3) are supported in this embodiment at one another via corresponding support elements (17) and are connected and interlocked with one another by suitable built-in positioning devices. The clamping devices (2, 3) form a stable clamping housing as a result. The positioning may be carried out in an external network reference or even in an internal body reference. The clamping devices (2, 3) are positioned here via suitable supports (not shown) in relation to body reference points, e.g., certain body openings. The body devices [sic - clamping devices? - Tr.Ed.] (2, 3) can be held by the robots (5) in the position shown. In case of corresponding supports at the body (8, 9), they may also be self-supporting.

It is possible in a variant of the exemplary embodiments to load the clamping devices (2, 3) with components (8, 9) to clamp them at the same time and to bring them into the correct position for joining by means of suitable feed devices (4, 5) only thereafter. This may happen, e.g., in a geo station or framing station, which corresponds, in principle, to the embodiment shown in Figure 11. As an alternative, the machining station (6) may also be of any other desired type and be used, e.g.,

as a welding station for the finishing welding of the body pretacked in the framing station.

The clamping devices (2, 3) for the side and roof area may have, in principle, the same design. Therefore, reference will be made below jointly to the exemplary embodiment of the lateral clamping devices (2) according to Figures 1 through 10 for explanation.

The clamping devices (2) shown in Figure 1 comprise a frame-like structure (12) each, in which a plurality of fixed and mobile clamping units (18, 19) are arranged, whose position and orientation are adapted to the course of the component clamping contour (11) and the component flange. The clamping units (18, 19) have the shape of flat strips, which are provided at the external edge with a plurality of clamping segments (20) arranged next to one another. These clamping segments (20) at the fixed and mobile clamping units (18, 19) come into contact with the component flange (11) in the clamped position and have the desired shape and are adapted correspondingly for this. A variable shape of the flange over the height, here in the Y axis, can also be assumed due to a corresponding shaping of the clamping segments (20). The clamping strips (18, 19) are preferably designed as flat plates, and changes in height may likewise be present, as an alternative, in the middle area for adaptation to bulges of the component flange (11). The clamping strips (18, 19) preferably have the narrowest shape possible, which follows the course of the flange on the outside and may be straight or concave on the inside to enlarge the free space (16).

The fixed and mobile clamping units (18, 19) are preferably present in associated pairs, four such pairs being arranged one after another in a closed ring corresponding to the contour of the opening in the component in Figure 1. The clamping devices (2) have, moreover, an adjusting device (21), which feeds and clamps the mobile clamping units (19) at the component flange (11).

As is illustrated in a cross section in Figures 2 and 3, the frame (12) likewise has an annular design and comprises a bottom part (13) and a cover part (14), which are arranged at spaced locations from one another and preferably in parallel to one another. They are kept at spaced locations from one another by struts or other, preferably thin connection parts (15) arranged outside the clamping units (18, 19) (cf. Figure 4) and are rigidly connected to one another. A kind of sandwich housing is thus formed, which accommodates the clamping units (18, 19) and at least parts of the adjusting device (21) in the internal distance or in the free space.

The clamping strips (18), which are a rigid part of the frame, are associated with the bottom part (13) in the embodiment being shown and are fastened to same. As an alternative, they may also be integrated within the bottom part (13). The mobile clamping strips (19) are supported at the cover part (14) and are guided in a suitable manner there. The frame (12) is oriented in relation to the components (8, 9) in Figure 1 such that the bottom part (13) is located in the rear in the direction of feed. The cover part (14) located in the front is moved through the component opening (10) during the feed. As is illustrated in Figure 2, the external contour of the cover part (14) stands back for this purpose in relation to the circumferential component flange (11). Likewise, the mobile clamping strips (19) can also be retracted inwardly to the extent that they are outside the overlap with the component flange (11) with their clamping segments (20) in the rearward inoperative position and can pass through the flange.

During the feed of the clamping devices (2), the frame (12) with the clamping strips (18), which are rigid parts of the frame, and with the clamping segments (20) thereof are positioned in a contact position and clamped position on the outside at the component flange (11). This is preferably also the welded or joined side. The mobile clamping strips (19) are then moved outwardly from the

rearward inoperative position and are brought into the clamped position on the internal side at the component flange (11). This is brought about in the embodiment being shown by two translatory movements directed essentially at right angles to one another, namely, a feed motion extending essentially along the extension of the flange and a clamping movement extending transversely, the so-called clamping stroke. The feed and clamping strokes are shown in Figures 2, 3 and 5. In addition, the inoperative positions of the mobile clamping strips (19) and of the clamping segments (20) are indicated by broken lines.

The adjusting device (21) moves the mobile clamping units (19) correspondingly. All mobile clamping units (19) in the clamping device (2) are preferably actuated together and simultaneously. As a result, the clamped connection is established simultaneously circumferentially in the entire area in which pressure is applied to the component flange (11). As an alternative, the clamping units (19) may also be actuated one after another in a controllable sequence.

The adjusting device (21) has one or more corresponding, suitable drives for actuating the clamping unit (19). In the embodiment being shown, it has a combined pushing and clamping drive (22, 23) for the feed and clamping strokes taking place one after another as well as the simultaneous admission of pressure to all mobile clamping strips (19). The adjusting device (21) has an individual drive motor (24) and a power divider (25) for this. The drive motor (24) may have any desired suitable design. It is a hydraulic or pneumatic cylinder in the exemplary embodiment being shown.

The mobile clamping units (19) arranged in the closed ring overlap one another at the points of impact in the contact or corner area with an offset in height and are mounted in a mutually

displaceable manner, and they are also supported against each other and mutually guide each other via sliding plates (33) and cover plates (34) in a positive-locking manner. Figure 2 illustrates this arrangement in a cross section. The respective clamping bars (19) located at the bottom are, moreover, guided in their direction of feed via strip-shaped guides (36) and sliding elements (37) located therein at the cover part (14).

To make it possible to transmit the drive movements to the mobile clamping strips (19), a total of four parallel cam shafts (26), which are mounted rotatably on a frame (12) and extend at right angles to the principal plane of the frame, are arranged at the corner areas and contact areas or points of impact of the mobile strips (19). The cam shafts (26) have preferably multi-armed actuating levers (27), which project transversely from the cam shaft (26) and are connected with the power divider (25), which is preferably designed as a crank mechanism. A cam shaft (26) is also connected with the connection of the piston rod of the cylinder (24) in an articulated manner. The cylinder (24) is mounted at the frame (12) in an articulated manner at the rearward end. The cam shafts (26) are rotated by the crank mechanism (25) simultaneously and by the same angle. Each mobile clamping strip (19) is fed at both ends by a cam shaft (26) each and brought into the clamped position.

The cam shaft (26) has two laterally bent feed cams (29), which are arranged one on top of another and apply pressure to the two mobile clamping strips (19) connected diagonally and are adjusted in height and angle in relation to one another for this purpose corresponding to the association of the strips. In addition, the cam shaft (26) has a clamping cam (31), whose actuation raises the connected clamping strip (19), while it carries the other, diagonally adjacent clamping strip (19) due to the positive-locking guiding. The feed and clamping cams (29, 31) are preferably arranged such

that the feed motions take place simultaneously and as a first movement, and that the clamping stroke takes place in the end area of the feed motion. Relatively short feed strokes and clamping strokes of, e.g., 5 mm, which are smaller than in the conventional individual clamping units, are necessary in the design shown in the exemplary embodiments.

The feed cams (29) are surrounded by sliding blocks (30), which are guided in corresponding openings at the clamping strips (19), to which pressure is applied, and convert the rotary movement of the cam into a translatory feed motion. To make it possible to perform the clamping stroke, there is a vertical mobility and a corresponding difference in height or thickness between the clamping strips (19) and their sliding blocks (30) or, as an alternative, between sliding blocks (30) and the feed cams (29).

The feed cam (31) arranged at the lower end of the cam shaft (26) likewise cooperates with a sliding block (32), which converts the rotary movement into a translatory displacing movement and actuates a clamping wedge arrangement (38, 39) in the process and generates the clamping stroke. A second clamping wedge (39) with oblique contact plane, which said clamping wedge is acted on by the sliding block (32) and is pushed obliquely upward along the wedge surface, is mounted movably on a clamping wedge (38), which is a rigid part of the frame. The cohesion of the clamping wedges (38, 39) is ensured by bilateral overlapping strips (42). The sliding movement of the mobile clamping wedge (39) is transmitted to a guide carriage (41), which is guided in such a way that it performs a translatory movement along a guide rail (40) on the underside of the clamping strip (19) to which pressure is applied. Due to a corresponding positive-locking connection between the sliding blocks (30, 32) and the corresponding openings, the clamping and feed strokes take place in the reversed direction and order during the reverse rotation of the cam

shaft (26).

As is illustrated in Figure 2, the clamping segments (20) are preferably designed as bent contour blocks, whose clamping surfaces are adapted in position and orientation to the course of the flange. The accurate height adjustment of the clamping segments (20) in relation to their clamping strips (18, 19) can be brought about by means of adjusting elements (35), e.g., ground shims. Because of the different height positions of adjacent mobile clamping strips (19) in the corner and contact area, additional height compensation measures are provided in order to ensure a continuous clamping contour.

The clamping segments (20) may be arranged in a closely spaced series-connected arrangement along the component flange (11) and have the outwardly directed claw geometry indicated by solid lines in Figure 2. A component-side edge area of the flange (11) may remain free now, at which, e.g., a laser seam welding can be performed with a pressing roller. The clamping segments (20) form the contour projecting farthest outwardly at the clamping device (2). In conjunction with the flat design of the frame, sufficient space is present for a laser welding head as a result. In addition, there is no shadowing during the remote laser welding with laser heads arranged at spaced locations, with which the laser beam migrates per scanner means or by a conveying movement of the laser head. Continuous laser weld seams are now possible without opening the clamping means (1).

Figure 2 shows a variant of the clamping segments (20) by broken lines, and their arrangement is inverted, so that they leave free the front edge of the component flange (11). In another variant, not shown, the clamping segments (20) may have a contoured front side and have, e.g., recesses in

order to make it possible to prepare laser-welded line seams in this free area in the clamped position. In addition, the clamping segments (20) may also be arranged at any desired laterally spaced locations from one another. Their design and arrangement depends basically on the shape of the flange and the requirements of the process and they may vary correspondingly as desired.

Figures 6 through 9 show another variant of the arrangement and shape of the clamping segments (20). These are arranged here on essentially U-shaped clamping arms (43), which are mounted freely rotatably via projecting supports (46) at the fixed and mobile clamping units (18, 19) by means of a drag bearing (47). Bilateral stop bolts act as a position limitation means (45) for the rotary movement of the clamping arms (43). The clamping arms (43) form so-called piano tensioners, wherein the front ends of the arm form the clamping segment and are in contact with the component flange (11) in the clamped position when the drag bearings (47) are flush with their axes. The rotation position is stabilized by the rearward arm ends, which likewise abut against one another and form a brace or counterstop (44). The active surfaces of the arm ends are now in a common plane each with the axes of rotation of the drag bearing (47) and with the center of the flange.

As Figure 9 shows as a tilted side view of Figure 8, the clamping arms (43) and the supports (46) overlap each other and have corresponding openings and projections for this. In this embodiment, the clamping segments (20) are located next to one another at the fixed and mobile clamping strips (18, 19) laterally in the longitudinal direction of the flange. This is also possible, in principle, in the above-described arrangement according to Figures 2 through 5.

In the variant according to Figures 6 through 9, Figure 6 shows the starting position of the clamping

arms (43) before the beginning of the feed stroke. The mobile clamping strip (19) now assumes the above-described retracted inoperative position. The rotary adjustments of the pivoted arms (43), which are allowed via the position limitation means (45), are indicated by broken lines. Figure 7 shows the subsequent position after the completion of the feed stroke of the mobile clamping strip (19). The drag bearings (47) and the pivoted arms (43) are now located flush one under the other in the direction of the clamping stroke, and the clamping stroke of the mobile clamping strips (19) into the end position according to Figures 8 and 9 takes place from this position.

In a variant of the embodiments shown, the pivoted arms (43) can respond correspondingly and likewise assume an oblique position in case of bent or obliquely standing component flanges (11).

Various variants of the embodiments shown and described are possible.

On the one hand, the clamping devices (2, 3) may remain at the components (8, 9) after the end of the first machining process and moved with these into the next machining station.

In another variant, the mobile clamping strips (19) and/or their clamping segments (20) can be fed by a pivoting movement and brought into the clamped position. In addition, any other desired feed and clamping movements are possible.

Furthermore, it is possible to accommodate auxiliary means, e.g., protective gas or exhaust means, in the clamping units (18, 19) and optionally also at the clamping segments (20). These may be integrated within the clamping segments (20) or, as an alternative, be arranged on the outside at these clamping segments (20). For example, protective gas lines may be installed on the outside at

the clamping segments (20) and detachably fastened by means of suitable clip connections or the like. The protective gas lines may have openings in the jacket, nozzles or the like for the desired discharge of gas in the needed areas.

Furthermore, the clamping devices (2, 3) may be parts of the joining and machining technique by containing, e.g., electromagnetic inductors for heating by means of high-frequency alternating fields, where sealants, adhesives or the like can be cured. Such a connection technique may be used instead of the hitherto common welding technique for the adhesive connection of the components (8, 9). The clamping devices (2, 3) can now be clamped and bonded in one operation. Longer residence of the clamping devices (2, 3) in the clamped position at the components (8, 9) and carrying during the further conveying is advantageous in this case.

In another variant, cooling means, which ensure, for example, a targeted cooling of the component and removal of heat, e.g., during welding, may be arranged at the clamping devices (2, 3).

In addition, the clamping segments (20) may have a height contour that deforms the component flange (11) and with which, e.g., embossed areas are formed on the component flange (11) in order to form free spaces for the release of gases from coated sheets during welding.

In the embodiment being shown, the clamping devices (2, 3) clamp a component flange (11) located on the inside at component openings (10). This association may also be reversed, in which case the components (8, 9) have, as in the example according to Figure 17 described in greater detail below, at least one outside component flange (11), which may extend essentially straight and/or extend, at least in some areas, diagonally or over an arc area. The shape of the clamping devices (2, 3) is

correspondingly adapted in this case, and the clamping devices form, e.g., an outside arc-shaped collar or ring, which surrounds the components (8, 9) at least in some areas, the clamping segments (20) being arranged on the internal side. The clamping device (2, 3) may also be arc-shaped at component openings (10) and extend only over a partial area of the opening circumference. The shape of the clamping devices (2, 3) may be adapted, in principle, to any course and contour of components (8, 9) and component clamping contours (11). The component clamping contours may have any desired and suitable design and do not have to be in the above-described flange form.

Further variants are possible concerning the design of the individual parts of the clamping devices (2, 3). This applies both to the shape and the design of the frame (12) and the fixed and mobile clamping units (18, 19) and the adjusting device (21). The latter may have, e.g., separate drive units for the feed stroke and the clamping stroke. The clamping stroke may, furthermore, be brought about with a different kinematics, e.g., by means of a coarse thread on the cam shaft with a corresponding crank.

Figures 12 through 16 show variants of the feed device (4, 5) for one or more clamping devices (2).

Figure 12 shows a front view of a machining station (6) with a feed device (5), which is provided for the internal feed of one or more clamping devices (2), which are fed, e.g., to two side walls (8, 9) through a roof opening from the top and from the internal side. The feed device (5) is designed in this variant as a lifting device with a stamp and a holder (48) for one or more clamping devices (2). The lifting device (5) may have, in addition, auxiliary axes, e.g., a longitudinal mobility. It is mounted in the machining station (6) in a suitable manner, e.g., at a station frame (50). The holder (48) has one or more auxiliary axes, with which it can move the clamping devices (2) taken up

laterally and feed them to the side walls (8, 9).

In the raised starting position, the holder (48) is withdrawn, so that it can pass through the roof opening or the free space between two individually held side walls (8, 9) with its two or four, bilaterally suspended clamping devices (2). Once having reached the interior space of the body, the holder (48) moves out laterally or spreads, feeding the clamping devices (2) being held to the side walls (8,9). The clamping devices (2) may now be fixed at the station frame (50) on the outside in the operating position by clamping, holding or the like. Figure 13 shows the corresponding position of the clamping devices (2) in the two door cutouts (10) of a side wall (8, 9) during the internal feed. The cover part (14) is not shown here.

Internal feed of two or more clamping devices (2) to two side walls (8, 9) of a vehicle body, which said side walls are located at spaced locations, likewise takes place in the variant according to Figures 14 and 15. The direction of feed is this time axial in the direction of the X axis of the machining station. The feed device (5) may be in this case a suitable conveyor (51), e.g., a carriage or the like, on which a suitable holder (48) is in turn arranged for one or more clamping devices (2). Due to the lateral mobility and the auxiliary axes of the holder (48), the clamping devices (2), which have first entered with a narrow contour, can then be spread out to the outside and fed.

Figures 14 and 15 also show that the clamping devices (2) may themselves be arranged at intermediate supports and especially at standardized feed modules (49). This offers a possibility of standardization for the holder (48), in which case only the feed modules (49) are adapted to the particular geometry of the clamping device and can be replaced together with the clamping devices (2).

In the variant according to Figure 16, the feed device (4) may be a clamping frame, which has a modular design on the basis of the above-mentioned feed modules (49). The feed modules (49) can be rigidly or detachably connected with one another herefor by suitable fixing means or supports (17). In particular, automatic change-over units may also be used here. The clamping devices (2) are in turn connected with the feed modules or clamping frame modules (49) via suitable supports (17).

Figure 17 illustrates the above-mentioned variant of the external clamping of component flanges (11). For example, the left-hand and right-hand component flanges (11) of the central B pillar (53) of the side wall (8, 9) of the body are clamped here. The clamping contour may optionally also extend partially into the adjoining roof and rocker panel area. The clamping device (2) has a multipart, frame-like structure (12) herefor, which has two spaced-apart, strip-shaped frame parts (54, 55) for a component flange (11) each and one or more connecting frame parts (56), e.g., connecting straps. Each of the frame parts (54, 55) has two clamping units (18, 19) in the above-described embodiment with fixed and mobile clamping strips and with a plurality of clamping segments (20).

Figure 17 illustrates further variants of the above-described embodiments. On the one hand, this applies to the feed and the holding of the clamping device (2). This [clamping device] may be fed, for example, manually by a worker and positioned at the component (7, 8). For example, the clamping device (2) may hang laterally movably on a bracket, a so-called balancer (not shown) in a laterally movable manner and balanced with a counterweight. The worker pushes the clamping device (2) with the mobile clamping units (19) retracted to the component (8, 9), e.g., the B pillar (53) shown in Figure 17, and then actuates the clamping drive (23). The positioning of the clamping

device (2) may be carried out, e.g., by means of slides or other positioning means at the connection straps (56), which engage corresponding positioning openings or other fixed points (not shown) on the B pillar (53). The clamping device (2) locks itself in the clamped position at the component flanges (11) and is supported at the component (8, 9). The supporting may be ensured via the clamping contour or optionally also via the positioning means.

Figure 17 also illustrates a variant of the design of the clamping drive (23). The latter may comprise. e.g., a manual drive (52), especially the ratchet shown. This [ratchet] may be arranged, e.g., on a cam shaft (26), in which case there is a positive-locking rotary connection by means of a detachable hexagon or the like. The rotating driving movement can be transmitted via a power divider (25) to the second cam shaft (26) and optionally to additional cam shafts.

In a variant of the exemplary embodiment according to Figures 1 through 5, which was described at the beginning, the clamping drive (23) may be taken over in a variant, not shown, by the feed device (5), especially a robot, while the cylinder (24) is eliminated. After the feed of the clamping device (2, 3) and the fixation of the clamping device, the robot (5) equipped with a change-over coupling becomes detached from the clamping device (2) and actuates one or more cam shafts (26) with a suitable rotary tool. The rotary tool can be grasped by the robot (5) from a magazine or, as an alternative, it may be located at the robot hand.

Figures 18 through 20 show various clamping situations for component edges or flanges (11, 11'). In the variant according to Figure 18, the component flanges (11, 11') lie flat on one another and are clamped in the contact position. This corresponds, e.g., to the embodiment shown in Figures 6 through 9.

In the variant according to Figures 19 and 20, it is possible to form a gap (57) between the component flanges (11, 11') in the clamped position. Alternately projecting pins (58, 58'), which extend through corresponding flange openings (59) of the respective associated and adjacent component flange (11, 11'), are arranged for this, e.g., at the clamping segments (20, 20'). In Figure 19, the pin (58) arranged at the upper, shaded clamping segment (20) presses the lower component flange (11') located opposite and presses same against the contact surface of the lower clamping segment (20'). Figure 20 shows the clamping situation at another point of the clamping contour, where the upwardly extending pin (58') at the lower, shaded clamping segment (20') presses the component flange (11) located opposite against the contact surface of the upper clamping segment (20). The length of the pins (58, 58') is greater than the thickness of the component flange (11, 11') passed through, so that the gap (57) of the desired size is formed due to the oversize of the pin. Both component flanges (11, 11') can be clamped firmly and securely by a plurality of pins (58, 58') directed in opposite directions and arranged alternately along the clamping contour and brought to the desired gap size.

LIST OF REFERENCE NUMBERS

1	Clamping means
2	Clamping device for side area
3	Clamping device for roof area
4	Feed device, clamping frame
5	Feed device, robot
6	Machining station
7	Machining tool
8	Component, body part
9	Component, body part
10	Component opening
11	Component flange, clamping contour, edge of component
11'	Component flange, edge of component
12	Frame, housing
13	Bottom part, fixed
14	Cover part
15	Connection part
16	Free space
17	Support
18	Clamping unit, clamping strip, fixed
19	Clamping unit, clamping strip, mobile
20	Clamping segment
20'	Clamping segment

21	Adjusting device
22	Feed drive
23	Clamping drive
24	Drive motor, cylinder
25	Power divider, crank mechanism
26	Cam shaft
27	Actuating lever
28	Bearing
29	Feed cam
30	Sliding block for strip feed
31	Clamping cam
32	Sliding block for clamping cam
33	Sliding plate for guiding strip
34	Cover plate for guiding strip
35	Adjusting element, shim
36	Guide for feed
37	Sliding element for feed
38	Clamping wedge arrangement, clamping wedge, fixed
39	Clamping wedge arrangement, clamping wedge, mobile
40	Guide rail for clamping wedge
41	Guide carriage for clamping wedge
42	Overlapping strip
43	Clamping arm
44	Brace, counterstop

45	Position limitation means
46	Support
47	Drag bearing
48	Holder
49	Feed module, clamping frame module
50	Frame, station frame
51	Conveyor
52	Manual drive, ratchet
53	Component element, B pillar
54	Frame part, strip
55	Frame part, strip
56	Frame part, strap
57	Gap
58	Pin
58'	Pin
59	Flange opening